20 Essential Oracle SQL and PL/SQL Tuning Tips

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Presenter

- John Mullins
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Webinar Objectives

- Gain insight and understanding of various SQL and PL/SQL tuning tips

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Tuning Tip #1

- SQL: Take advantage of the result cache feature
  - The result cache is a memory structure used to store the results of identified queries
  - Similar to materialized views, but only in memory
  - Great for queries that read a lot of data to produce small result sets that are repeated in an environment where changes to the data is infrequent
  - User written functions can be created as result cache functions (see tip #2)

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The Result Cache

- Benefit: Reduces memory reads
- Can be implemented with:
  - Database parameter
    - result_cache_mode
  - Hints
    - result_cache, no_result_cache
  - User written functions (see tip #2)

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Tuning Tip #2

- PL/SQL: Take advantage of result cache functions

```
CREATE OR REPLACE FUNCTION AVG_SAL_DEPT
(v_deptno IN NUMBER)
  RETURN NUMBER
  RESULT_CACHE
IS
    v_avg NUMBER;
BEGIN
   SELECT avg(sal) INTO v_avg FROM emp
   WHERE deptno = v_deptno;
   RETURN v_avg;
END;
```

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Tuning Tip #3

- SQL: Gather extended statistics if necessary
  - Problem: By default, the optimizer does not recognized relationships between columns, like job_id within department_id
  - The result is an inaccurate cardinality estimate because default statistics are based on individual objects and not combined objects
  - The above result can then cause a bad execution plan to be chosen if data has an uneven distribution between combinations

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Extended Statistics

```
SELECT dbms_stats.create_extended_stats
(null,'TABLENAME','(column1,column2)')
FROM dual;
```

```
exec dbms_stats.gather_table_stats
   (null,'TABLENAME',method_opt=>'for all
   columns size skewonly for columns
   (column1,column2)');
```

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Tuning Tip #4

- PL/SQL: Take advantage of bulk processing features
  - Problem: PL/SQL sends SQL statements to the SQL engine for processing, this is called a context switch
  - Benefit: Reduces context switches between the PL/SQL and SQL engines improving performance

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Bulk Processing

- Examples:

```
SELECT order_id, order_status_cd
BULK COLLECT INTO v_order_ids, v_order_status_cds
FROM product_order;

FORALL i IN v_order_ids.FIRST..v_order_ids.LAST
    UPDATE product_order
    SET shipment_date = shipment_date + 1
    WHERE order_id = v_order_ids(i);
```

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Tuning Tip #5

- SQL: Avoid NOT Logic
  - Problem: Certain syntax can cause the optimizer to not consider an index
    - Operators such as <>, !=
    - Functions processing indexed columns
      - WHERE upper(ename) = 'SMITH'
    - Implicit conversions
    - LIKE '%A'
    - Arithmetic operations or || operator

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Tuning Tip #6

- PL/SQL: Pass parameters by reference
  - By default, OUT and IN OUT parameters are passed by value
  - Problem: When these types of parameters represent large data structures such as records or arrays (collections), passing by value slows down execution and uses up memory
  - Use the NOCOPY option when passing these parameters

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Pass Parameters by Reference

- Example:

```
CREATE OR REPLACE PROCEDURE p1
 (p1_value IN OUT NOCOPY number)
AS
…
BEGIN
…
END;
```

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Tuning Tip #7

- SQL: Perform joins with the correct join method
- Common join methods:
  - Nested Loop Join, Hash Join, Sort-Merge Join
- Examine your Explain Plan output

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Perform Joins with the Correct Join Method

- Generally:
  - Nested loop join is better for joining small result sets where the join columns are indexed
  - Hash join is better for joining larger result sets where one or more indexes are missing on the join columns
  - Sort-Merge join is better than nested loop joins for joining larger result sets but typically not as good as hash joins

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Tuning Tip #8

- SQL and PL/SQL: Compare performance between alternative syntax for your code
  - There is typically more than one way to get the same result
  - It typically cannot be said that one way is "ALWAYS" better than another way, just be aware of the other ways

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Compare Performance Between Alternative Syntax for your Code

- Problem: Find all the customers that have not placed an order
  - There is a CUSTOMER table containing all customers and a PRODUCT_ORDER table containing orders placed by customers
  - Could be solved using an "Anti-Join", NOT IN with a subquery, EXISTS with a subquery, or with a MINUS set operator

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Tuning Tip #9

- SQL: Use correlation ids when performing joins, even on columns where they are not required

```
SELECT e.last_name, d.department_name, ep.salary,
j.job_description
FROM employee e, department d, employee_private ep, job j
WHERE e.department_id = d.department_id AND
e.employee_id = ep.employee_id AND
e.job_cd = j.job_cd;
```

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Tuning Tip #10

- SQL: Analyze joins one by one and check that their use makes sense in each circumstance
  - The optimizer does the same thing
  - What was joined first? Was it a nested loop join, a hash join? Does that join method make sense? If so, move on to the next join, if not, continue to analyze this join before moving on

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Tuning Tip #11

- SQL: Eliminate rows as early as possible in the join order
  - Examine your Explain Plan output
    - If filters (WHERE clause conditions) are in the query along with joins, where in the execution plan do the filters take place in regards to where the joins take place?

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Tuning Tip #12

- SQL and PL/SQL: Understand potential bottlenecks within Oracle's architecture
  - Memory Structures
    - The Buffer Cache (All flavors of data)
    - The Shared Pool (Your code and supporting information)
    - The PGA (Temporary work area – sorts for example)
    - The Redo Log Buffer (Data changes)
  - Redo Log Files
    - Data changes

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Tuning Tip #13

- SQL: Understand blocks and block size
  - Table and index data are stored in blocks at the lowest level of the Oracle architecture
  - Oracle reads one or more blocks at a time
  - Each block has storage parameters
    - PCTFREE, PCTUSED
  - Key: Read the fewest number of blocks possible to get the desired result set

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Tuning Tip #14

- SQL: Be aware of session and system parameters and their settings, they can influence the execution plans of your queries
  - optimizer_mode
  - db_file_multiblock_read_count
  - optimizer_index_caching
  - optimizer_cost_adj

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Tuning Tip #15

- SQL: When creating multiple column indexes, choose an optimal order of the columns within the index
  - In general, the leading column of the index should be the one most likely to be used in WHERE clauses and also the most selective column of the set
    - NOTE: To take advantage of the Index Skip Scan feature, Oracle expects the least selective columns at the front of the index. Follow the most selective rule first, worry about skip scan down the line

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Tuning Tip #16

- SQL: Avoid unnecessary sorts, know what the PGA is and how it works
  - Sorts or temporary work space usage is needed by code containing:
    - ORDER BY, DISTINCT, GROUP BY, UNION, INTERSECT, MINUS, Hash Join, Sort-Merge Join, creating an index, generating statistics

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The PGA Memory Structure

- The PGA is the memory structure used to perform temporary work for various operations
- If the temporary work needed cannot be accomplished in the PGA, then its either performed on disk in a temporary tablespace or the optimizer chooses a different operation
- By default, an individual process cannot consume the entire PGA

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Tuning Tip #17

- PL/SQL: Do not overuse SELECT…FROM dual; Especially for repeated statements. This applies to using functions to accessing sequences, etc…
  - Instead of:

    ```
    SELECT sysdate INTO v_date FROM dual;
    ```

  - Do:

    ```
    v_date := sysdate;
    ```

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Tuning Tip #17 (continued)

- Instead of:

```
SELECT sequence1.NEXTVAL
INTO v_id FROM dual;
```

- Do:

```
v_id := sequence1.NEXTVAL;
```

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Tuning Tip #18

- SQL and PL/SQL: Develop, enhance, enforce and follow SQL and PL/SQL standards documents
  - Examples: Formatting standards, coding standards, which loop construct to use (FOR loop, WHILE loop, basic loop, which decision construct to use (IF-THEN-ELSE, IF-THEN-ELSIF, Simple CASE, Searched CASE), Join Syntax (SQL-86, SQL-92), etc…

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Tuning Tip #19

- SQL and PL/SQL: Take advantage of available tuning tools
  - SQL Tuning Advisor
  - PL/SQL Profiler
  - Explain Plan
  - Autotrace
  - Trace events 10046 and 10053

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Tuning Tip #20

- SQL: Use hints as a temporary solution
  - Some common hints:
    - INDEX, ORDERED, USE_HASH, PARALLEL, ALL_ROWS, FIRST_ROWS, APPEND, CACHE, RESULT_CACHE

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Summary

- Oracle SQL and PL/SQL tuning is a huge task
- There are many techniques that can be used to improve performance
- Questions?
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For More Information

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